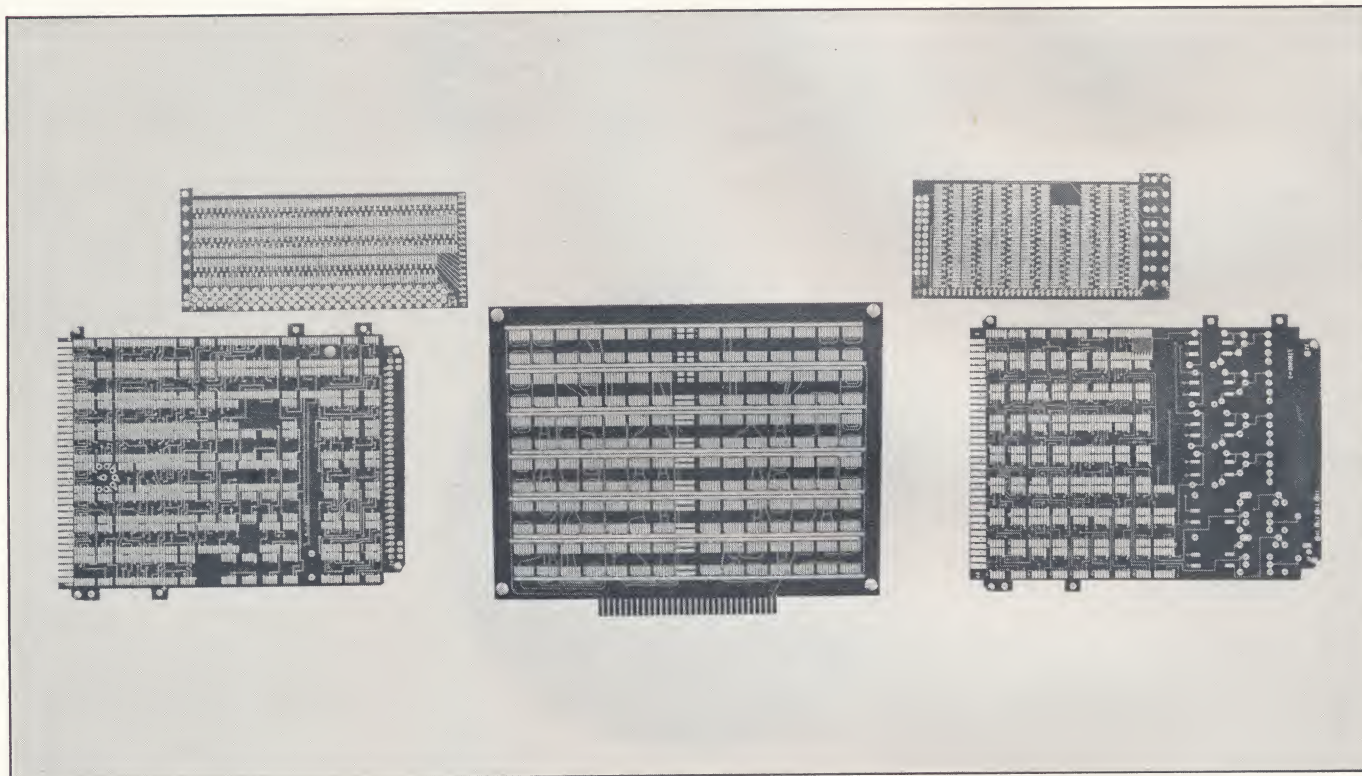


INTELLUX INCORPORATED, SANTA BARBARA RESEARCH PARK, 26 COROMAR DRIVE, GOLETA, CALIFORNIA, PHONE (805) 968-3541, CABLE: INTLUX



### GENERAL DESCRIPTION

INTELLUX Multilayer Printed Wiring Boards are three-dimensional electro formed circuits within a mechanical support. Outstanding reliability of complex crossover circuitry is assured because each individual circuit — whether it is in a plane (layer), or is on several layers inter-connected to each other — is a monolithic structure of electrolytic copper. Junctions are eliminated and interlayer connections are busses (posts) of solid copper. Reliability is immeasurably improved by eliminating the ordinary techniques that are, at best, marginal. There are no conductive pastes, plated-through holes or solder joints within the circuitry structure.

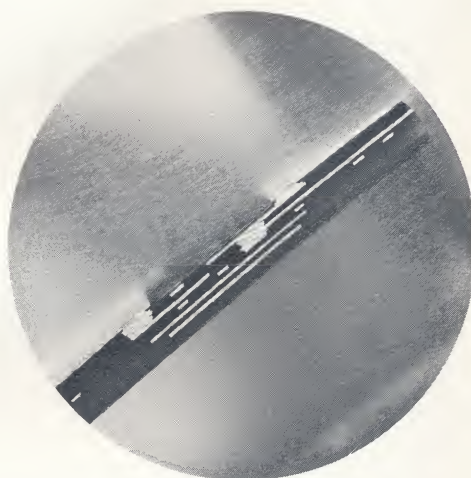
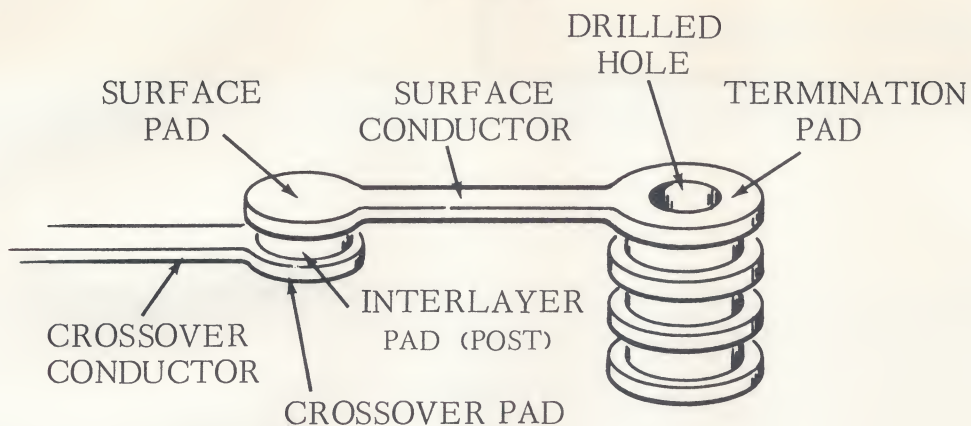
The INTELLUX process offers both economical and functional advantages where the complexity of the circuit requires more than two layers of electrical crossover.

This technique enables:

- maximum component density. Inasmuch as no circuit area is used for layer-to-layer or layer-to-surface connections, it is possible to assemble in excess of 110 flat packs on one side of a typical 5" x 7" p.w. board (without resorting to small inadequate conductor sizes).
- reduction in the number of crossovers by 50% when compared with other multilayer techniques.
- incorporation of complete or partial shielding for circuit isolation.
- completely hidden first surface circuitry (especially useful where dip-solder techniques are to be employed).
- the ability to incorporate circuit-isolated pads for design flexibility, integral heat-sinks, and extended high peel strength tabs for weld-mounting components.

### 3-D CIRCUITRY DESIGN GUIDE

#### Terminology



### MULTILAYER CIRCUIT DESIGN GUIDE

#### Introduction

The Multilayer Circuit Design Guide has been especially prepared for the convenience of those who wish to design their own circuits and artwork. It will also serve to orient customers with respect to the criteria used at Intellux in design and artwork development.

#### Substrates

Normal substrates are epoxy glass, epoxy paper or aluminum. Other substrate materials will be provided upon request.

#### Component Attachment

Materials available for surface component attachment include:

- Copper/Solder (reflowed or wicked)
- Copper/Gold
- Nickel/Gold, Nickel
- Kovar, Dumet

#### Art Work

Maximum size, 36 inches square.

Art accuracy (post location) must be less than .002 X the reduction.

To assure tolerances, artwork is subject to review by Intellux.

#### Electrical Parameters

Dielectric constant: 5 (maximum) at 1 megacycle.

Maximum current loading: 1 ampere per 10 square mils conductor cross section.



## DESIGN PARAMETERS

| SURFACE                                         | STANDARD                 |                              | HI-DENSITY                |                              |
|-------------------------------------------------|--------------------------|------------------------------|---------------------------|------------------------------|
|                                                 | Flush epoxyglass surface | Non-flush epoxyglass surface | Flush epoxy surface       | Non-flush epoxyglass surface |
| Conductor Width                                 | .020 <sup>1</sup>        | .020 <sup>4</sup>            | .005                      | .010 <sup>4</sup>            |
| Pad Diameter                                    | .050 <sup>2</sup>        | .050 <sup>4</sup>            | .015                      | .030 <sup>4</sup>            |
| Conductor Spacing                               | .030                     | .020                         | .005                      | .010                         |
| Pad to Pad Spacing and Pad to Conductor Spacing | .030                     | .020                         | .015                      | .015                         |
| <b>CROSSOVER</b>                                |                          |                              |                           |                              |
| Conductor Width                                 | .020                     | .020                         | .010                      | .010                         |
| Pad Diameter                                    | .045                     | .045                         | .015                      | .030                         |
| Conductor Spacing                               | .020                     | .020                         | .010                      | .015                         |
| Pad to Pad Spacing and Pad to Conductor Spacing | .030                     | .030                         | .015                      | .015                         |
| <b>MISCELLANEOUS DIMENSIONAL</b>                |                          |                              |                           |                              |
| Surface Circuitry Thickness                     | .0015 - .003 ± .001      | .0015 - .003 ± .0005         | .0015 ± .0005             | .0015 - .003 ± .0005         |
| Crossover Circuitry Thickness                   | .0015 to .0025 ± .0005   | .0015 - .004 ± .0005         | .0015 ± .0005             | .0015 ± .0005                |
| Minimum Interlayer Pad Width                    | .045                     | .035                         | .010                      | .020                         |
| Interlayer Pad Height and Insulation Thickness  | .002 min.                | .002 Min.                    | .0025 ± .0005             | .0025 - .0035 ± .0005        |
| Surface Pad Diameter Excess over Interlayer Pad | None                     | .015 <sup>5</sup>            | .004 to .006 <sup>5</sup> | .010 <sup>5</sup>            |
| <b>ELECTRICAL</b>                               |                          |                              |                           |                              |
| Insulation Dielectric Strength                  | 500 VAC - 1 Min.         | 500 VAC - 1 Min.             | 500 VAC - 1 Min.          | 500 VAC - 1 Min.             |
| Insulation Resistance Min.                      | 3000 Megohms             | 3000 Megohms                 | 300 Megohms               | 300 Megohms                  |

### NOTES:

<sup>1</sup> All dimensions in inches.

<sup>2</sup> Artwork should be made .004" to .006" less than desired pad diameter.

<sup>3</sup> First layer.

<sup>4</sup> For Nickel component attachment surface, artwork .010 larger than desired final size.

<sup>5</sup> This is most critical.

### Drilled Holes

The distance between the edge of holes drilled in circuitry and the outside edge of the circuitry must not be less than .005 inches.

Minimum drilled hole sizes:

| Substrate thickness, inches | Hole size, inches |
|-----------------------------|-------------------|
| .050                        | .018              |
| .050 to .075                | .024              |
| .075 and up                 | .032              |

Hole locating accuracy: Normal, .005

Special, .003

Holes for eyelets or terminals to be .001" to .004" greater than eyelet or terminal outside diameters.

Normal minimum eyelet O.D. is .031 inches.

Where metal substrates are used, the clearance holes in the substrate must be .050" larger than the conductor holes.

### Shielding

Perforated interlayer shielding recommended for circuits operating at frequencies above 1 mc to minimize interlayer capacitance effects.

Complete shielding can be provided for one or more conductors.

### Miscellaneous

All interlayer pads and circuitry must have electrical continuity to the surface except on special order.

Maximum area available for circuitry is 13" x 15½". Allow 1/8" spacing between individual circuit boards for cutting. A 15½" x 15½" area is available for special orders.

All circuitry to be .050 away from any machined edge.

Termination pads must either: (1) extend down to substrate via interlayer and crossover pads; (2) be on a board with epoxy glass surface.

Termination pad diameter, if eyeletted, must be at least .040" greater than eyelet flange.

Board thickness does not include height of termination or component attachment pad.

# MULTILAYER CIRCUIT PERFORMANCE CHARACTERISTICS

| ELECTRICAL                                            | STANDARD                                                                        | HI-DENSITY               |
|-------------------------------------------------------|---------------------------------------------------------------------------------|--------------------------|
| Insulation Resistance (min.)                          | 3 x 10 <sup>9</sup> ohms                                                        | 3 x 10 <sup>8</sup> ohms |
| Dielectric Strength (min.)                            | 500 VAC                                                                         | 500 VAC                  |
| Dielectric Constant at 1 Mc                           | 5                                                                               | 5                        |
| Coupling Capacitance, Crossed Line                    | 0.1pf(typ)                                                                      | 0.02pf(typ)              |
| MECHANICAL                                            |                                                                                 |                          |
| Circuit Materials:<br>Component Attachment<br>Surface | Gold, Silver, Nickel<br>Rhodium, Copper, Solder<br>Plate, Kovar and<br>Dumet    | Same                     |
| Surface Material                                      | .003 in. Epoxy<br>Fiberglass or<br>Filled Epoxy Resin                           | Same                     |
| Internal Conductors                                   | Copper or Nickel                                                                | Same                     |
| Peel Strength, Epoxy-Glass Surface                    | 6 lb/in.                                                                        | Same                     |
| Insulation                                            | Epoxy resin with<br>appropriate fillers                                         | Same                     |
| Substrate:                                            | As required                                                                     | As required              |
| Conductor:                                            |                                                                                 |                          |
| Width                                                 | .020 Min.                                                                       | .005 Min.                |
| Thickness                                             | .0015 to .004 ± .0005                                                           | .0015 ± .0005            |
| Land Areas, Minimum                                   | .050 on .070 centers                                                            | .020 on .035 centers     |
| Terminations                                          | Strip type connectors,<br>solder pads, weldable<br>nickel, eyelets or terminals | Same                     |
| Solderability                                         | Mil-Std-202<br>Test Method 210,<br>Condition A                                  | Same                     |
| Solder Conditions,                                    | 460°F, 1 min. max.                                                              | Same                     |
| Flux Removal                                          | Isopropyl alcohol<br>or Freon                                                   | Same                     |
| ENVIRONMENTAL                                         |                                                                                 |                          |
| Operating Temperature                                 | -55°C to +125°C                                                                 | Same                     |
| Thermal Shock                                         | Mil-Std-202<br>Test Method 107, -60°C<br>to +125°C                              | Same                     |
| Moisture Resistance                                   | Mil-Std-202<br>Test Method 106                                                  | Same                     |
| Shock                                                 | Mil-Std-202<br>Test Method 205                                                  |                          |
| Vibration, High Frequency                             | Mil-Std-202<br>Test Method 204<br>80-2000 CPS                                   | Same                     |
| Humidity                                              | Mil-Std-202<br>Test Method 106                                                  | Same                     |
| Altitude                                              | Mil-Std-202<br>Test Method 105<br>Condition G                                   | Same                     |
| Salt Spray                                            | Mil-Std-202<br>Test Method 101                                                  | Same                     |
| Fungus                                                | Mil-E-5272                                                                      | Same                     |
| Sand and Dust                                         | Mil-Std-202<br>Test Method 110                                                  | Same                     |
| Fungus                                                | Mil-E-5272<br>(Para 4.8)                                                        | Same                     |
| Acceleration                                          | Mil-Std-202<br>Test Method 212<br>Condition A                                   | Same                     |